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**INTERGENERATIONAL AND
INTERNATIONAL TRADE**

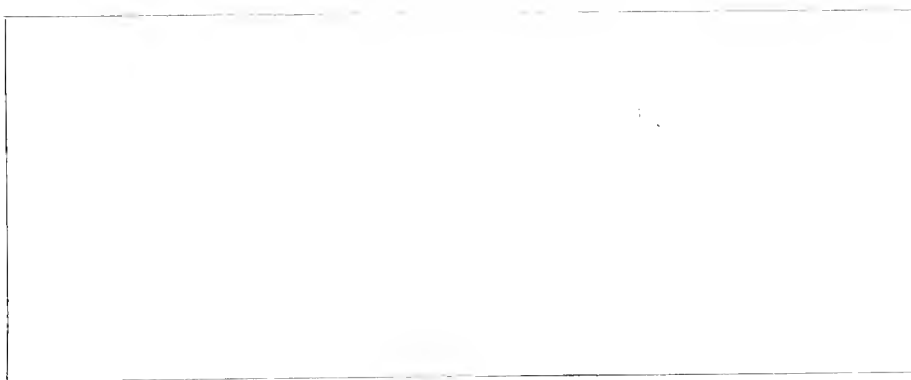
Rudiger Dornbusch

M.I.T. Working Paper #348

June 1984

**massachusetts
institute of
technology**

**50 memorial drive
cambridge, mass. 02139**

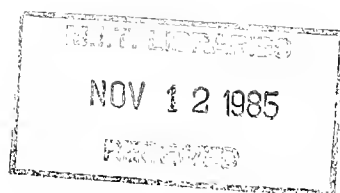


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INTERGENERATIONAL AND INTERNATIONAL TRADE*

Rudiger Dornbusch

Massachusetts Institute of Technology

Intertemporal trade theory, in an optimizing framework, has been studied in influential papers by Gale (1971, 1974) and more recently by Buiter (1981), Fried (1980) and Kareken and Wallace (1977), Svensson and Razin (1983), Sachs (1982), and Persson (1983). Although the basic models differ the papers address common welfare questions relating to international lending. This paper shares the same objective, but also overlaps with a strand of literature that studies the time path of longterm asset prices in a stochastic optimal consumption setting. This literature, in particular the Lucas (1978), Grossman and Shiller (1981) and Leroy and LaCivita (1981), explores the effects of present and anticipated future output disturbances on asset prices and relates asset price movements to the movements in underlying fundamentals. The present paper combines the two strands of literature in a deterministic model with international lending, overlapping generations and longterm, real assets.

The intergenerational model turns out to be interesting for open economy issues: Opening trade in securities with sufficiently comprehensive compensation will improve welfare. But under more restricted compensation welfare deteriorate in the low interest rate country, even taking into account the possibility of intergenerational transfers. Debt issue must worsen the current account and deteriorate steady state welfare for the issuing country. Current, permanent income growth raises welfare and deteriorates the longrun trade balance. Of particular interest are results regarding future events or transitory disturbances. Here we show that a transitory rise in income has the same effect

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on the current account as a permanent change, although asset prices change more than in the permanent case if the intertemporal elasticity of substitution in consumption is less than unity. Section 1 and 2 set out the basic

intergenerational model of consumption and saving for the closed economy.

In Section 3 the open economy equilibrium is introduced and the model is applied to discuss the benefits from trade in securities and some comparative static results are derived.

1. The Model

Households live two periods, working in the first but consuming in both. In the working part of their life they receive an exogenous disposable income, w , which is in part consumed and in part saved to finance second period consumption. At any point there are two generations, with an equal number of households. The only asset in the economy are real consols that pay one unit of the single consumption good indefinitely. Specifically there is no productive capital nor storeable output. These consols are issued by the government and serviced by a lumpsum tax on the working generation.

Thus with a stock of debt outstanding equal to b disposable income of the young, w , is equal to output less debt service:

$$w \equiv \tilde{w} - b \quad (1)$$

where \tilde{w} is the output endowment. The young apply their savings to purchasing consols from the old. The old, in the second period of their lives, consume the coupon income and sales proceeds of the consols. The consol price depends on the longterm interest rate but the saving response of the young is geared to the short-term interest rate. We therefore note the relation between short (one period) and longterm asset prices:

$$p_t = q_t(1 + p_{t+1}) \quad (2)$$

where p_i is the consol price in period i which equals the present value of the next period coupon plus the resale price. The term q_t is the one period discount factor that depends on the shortterm interest rate.

Households maximize a two-period utility function

$$U = V(c_1) + V(c_2) \quad ; \quad V' > 0, V'' < 0, \lim_{c \rightarrow 0} V'(c) \rightarrow \infty \quad (3)$$

subject to the budget constraint $c_1 + qc_2 = w_1$ yielding the first order condition:

$$qV'(c_1) = V'(c_2) \quad (4)$$

The first order condition, in conjunction with the budget constraint, gives rise to the consumption and savings function:

$$c_1 = c_1(q, w) \quad , \quad s = s(q, w) \quad (5)$$

2. Equilibrium Asset Prices in the Closed Economy

Asset prices are determined by the equilibrium condition in the goods or asset market. Equilibrium obtains when the demand for goods by the two generations is equal to the total supply or, equivalently, when saving by the young equals the value of consols outstanding:¹

$$s(p_t/(1+p_{t+1}), w_t) = p_t b_t \quad (6)$$

where we have substituted from (2) for q_t in terms of present and future longterm asset prices.

We can equivalently state the equilibrium condition in terms of the first order condition in (4), using (2) and (6), to obtain:

$$p_t V'(w - p_t b) = [1 + p_{t+1}] V'(b_t [1 + p_{t+1}]) \quad (6a)$$

The equilibrium asset price satisfying (6) or (6a) is in general governed by a

¹Goods market equilibrium requires that output, \tilde{w} , be equal to demand:

$\tilde{w} = c_1(q, w) + (1+p)b$ or $w - c_1 \equiv s = pb$.

difference equation. A special case, however, arises for the logarithmic utility function, $V(c) = \ln c$. In this case the equilibrium consol price is equal to:²

$$p_t = w_t / 2b_t \quad (7)$$

The interesting feature of (7) is that longterm asset prices depend only on current disposable income and current asset stocks outstanding. The future path of income or asset supplies has no effect on consol prices.

The general case is described by equation (6a) and one possibility is shown in Figure 1. The schedule $J(w, b)$ shows the difference equation in (6a) on the assumption that the elasticity of the marginal utility of consumption $\theta(c) = -V''(c)c/V'(c)$ is smaller than unity. In that case the relation between p_t and p_{t+1} is positive with an intercept $0 < \bar{p}_t < w/b$. A unique steady state equilibrium will exist at point A since, by assumption, the marginal utility of consumption tends to infinity as consumption tends toward zero so that p_{t+1} must grow indefinitely as p_t approaches w/b .³

The case where the elasticity of the marginal utility is larger than unity leads to a negatively sloped $J(\)$ schedule as shown in Figure 4 below. We note that the elasticity of the marginal utility has a ready interpretation in terms of intertemporal substitution. At a zero interest rate consumption is equalized across time. In that case $1/\theta(c)$ measures the intertemporal elasticity of

²Fischer (1981) has discussed this case in a stochastic setting in interpreting results by Lucas (1978).

³The slope of the $J(\)$ schedule is $dp_{t+1}/dp_t = [V'(c_2) + (1+p_{t+1})bV''(c_2)]/[V'(c_1) - p_t bV''(c_1)]$. Noting the definition of the elasticity of marginal utility we can see that the slope is positive if $\theta(c)$ is less than unity.

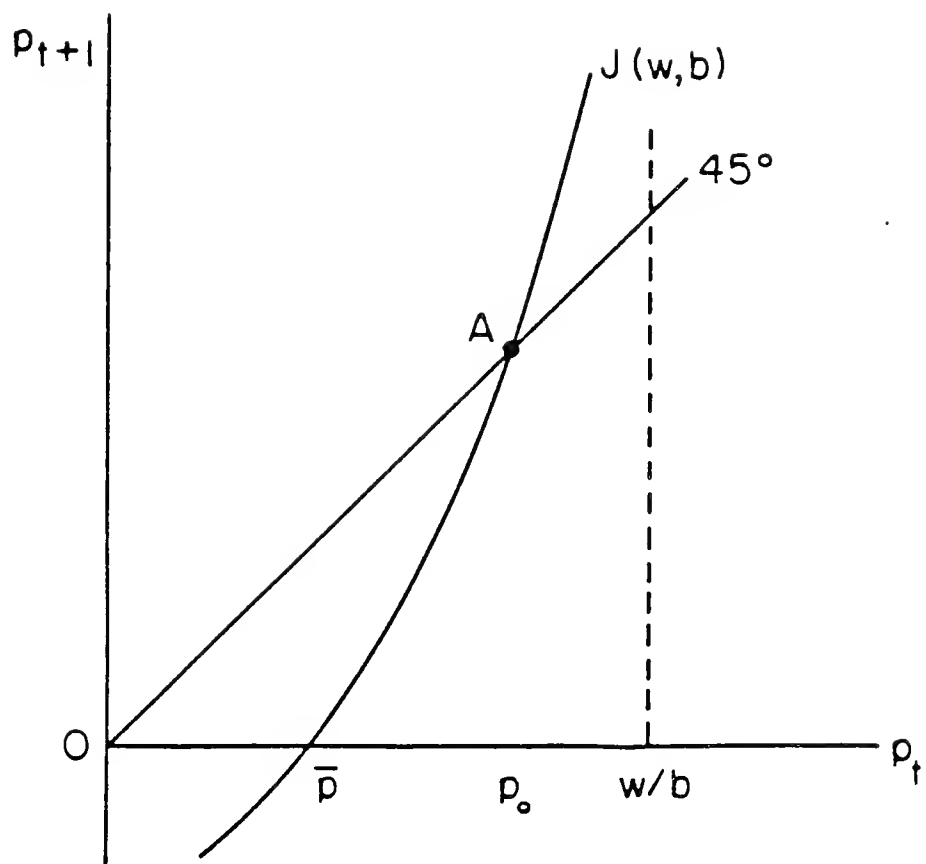


FIGURE 1

substitution.⁴ Thus the case of nearly constant marginal utility implies a high degree of intertemporal substitution and conversely for a highly concave utility function.

Point A in Figure 1 is the steady state equilibrium. Consider now the adjustment process. It is apparent from the diagram that the only dynamics possible is an immediate jump to the steady state level of prices p_0 . A path starting with a high level of current prices would imply that the value of bonds comes to exceed the wage of the young implying a path that cannot be sustained. Alternatively, a lower starting price involves ultimately negative prices for the right to future incomes. Accordingly the only adjustment consistent with perfect foresight is an immediate jump to point A.

In the case of an elasticity of substitution smaller than unity the $J(\)$ schedule is negatively sloped as in Figure 4 and two possibilities arise in respect to the dynamics. If the slope at the 45° line is larger than unity in absolute value we have again an immediate jump to the steady state as the only perfect foresight path that does not violate the budget constraint. But in the alternative case adjustment consistent with perfect foresight and the equilibrium conditions of the model can be a damped oscillation starting from any initial condition. In the constant elasticity case this possibility arises if the elasticity of saving with respect to the relative price of future goods is

⁴From the first order condition we have by logarithmic differentiation $d\ln(c_1/c_2) = (1/\theta(c))d\ln q$ where by assumption the expression is evaluated at $c_1 = c_2 = c$. To fix ideas we can think of a constant elasticity utility function $V(c) = \frac{1}{1-\theta} c^{1-\theta}$. In this case equation (6a) becomes

$$p_{t+1} = \left[\frac{p_t^{1/\theta}}{w/b - p_t} \right]^{\theta/(1-\theta)} - 1.$$

positive but small.⁵

Welfare Aspects

In Figure 2 we show the schedule $\tilde{w}\tilde{w}$ which is the social consumption possibility schedule and is a 45° line. The budget line facing an individual is, however, ww' which differs from $\tilde{w}\tilde{w}$ by the presence of debt service, $\tilde{w} - w$, and positive interest. Equilibrium will be at a point like A. The equilibrium is steady state welfare maximizing. Increased debt, because it raises the equilibrium interest rate, moves the economy to a point on $\tilde{w}\tilde{w}$ to the north-west of A'. It lowers welfare by moving the economy further away from a zero interest rate equilibrium.

The existence of consols (or simply sufficiently longterm bonds), in this model imposes a welfare cost because interest rates cannot be zero. In this respect the model differs from one where the government debt takes the form of government issue of one-period debt. It is readily verified that if the government were to issue a stock of debt equal to $\tilde{w}/2$, rolled over every period and thus not requiring debt service, the economy would be in a socially efficient state with zero interest and equal consumption in every period.

The equilibrium at point A' implies lower steady state welfare than point E which would be attainable under an alternative debt scheme. But that does not imply that the equilibrium at A' is pareto inferior. It is clear that society cannot move from A' to A, raising first-period consumption of the young, without making the old generation, in the transition, worse off.

Another feature of the consols, which sets them apart from money as it has been studied in overlapping generation models in particular by Neil Wallace, is the presence of a coupon. To smooth consumption intertemporally all that is

⁵Using the expression for the slope of the $J(\)$ function it is readily shown that the condition $(-1)dp_{t+1}/dp_t < 1$ implies $(c_1/w)(1-1/\theta) < 1/(1+q)$. The expression $(c_1/w)(1-1/\theta) = \partial \ln s / \partial \ln q$ is the elasticity of saving with respect to the relative price of future goods.

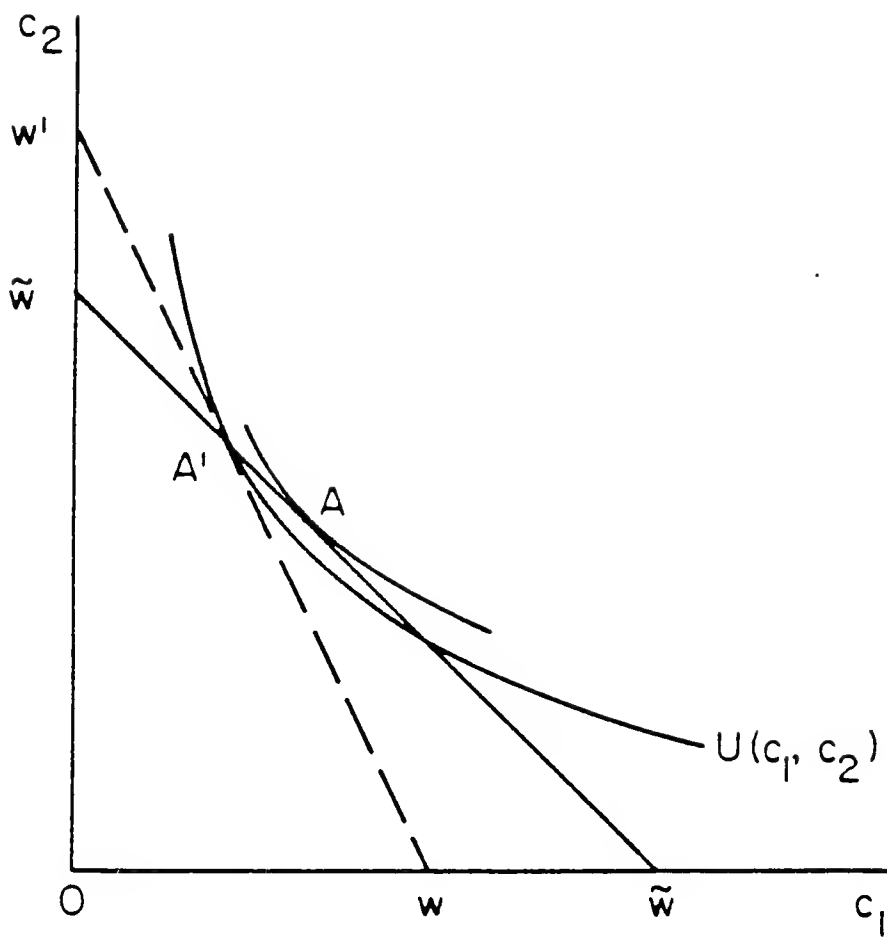


FIGURE 2

required is any kind of government debt, including debt that is a claim to nothing such as a zero-coupon consol. But the fact that the consol does carry a coupon imposes a structure different from monetary models because of the need to raise revenue for debt service.

We conclude by showing the welfare change associated with a change in income or asset prices. From (1), the budget constraint and the first order conditions the change in lifetime utility, measured in terms of first period consumption, is:

$$dU/V'(c_1) = dc_1 + qdc_2 = dw - c_2dq \quad (8)$$

Thus a household's welfare is improved by a rise in disposable income and by a decline in the relative price of future goods or rise in the shortterm rate of interest. The young are lenders and therefore a decline in the relative price future goods improves their terms of trade and welfare.

The Effects of Changes in Income

For comparative static questions we look at Figure 3 where we show the effect of an increase in income. The simplest case is that of a current, unanticipated and permanent increase in income. This is shown by an outward rotation of the schedule $J(w,b)$, to J' .⁶ Initial steady state equilibrium was at point A and the new equilibrium is at A'. The increase in income therefore raises asset prices or lowers interest rates. The interpretation is straightforward: Higher income, at unchanged interest rates, raises saving by the young and thus creates an excess demand for debt. To restore equilibrium in the capital market asset prices must rise. The increase in asset prices or fall

⁶The rightward shift of the $J(\)$ schedule from (6a) is given by $dp_t/dw = -p_t V''(c_1)/[V'(c_1) - p_t b V''(c_1)] > 0$.

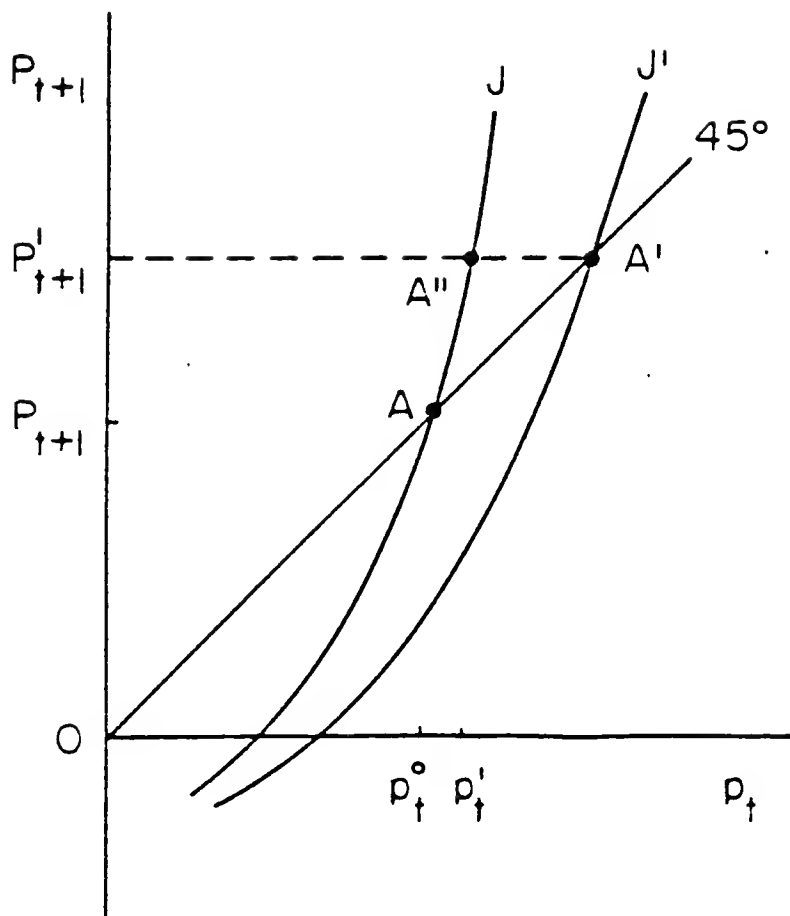


FIGURE 3

in interest rates establishes capital market equilibrium by lowering saving and increasing the value of consols outstanding.

A current, permanent increase in income will raise asset prices independently of the saving response to interest rates. This can be seen from Figure 4 where we show the case of $\theta(c) > 1$ so that saving declines with increased interest rates. Increased income, here too, raises asset prices. This is the case because the effect of the decline in interest rates exerts a relatively stronger effect on the value of bonds outstanding than on the supply of saving. The result is possible because the elasticity of saving with respect to the interest rate is less than unity.⁷

We consider next an increase in income expected to occur one period hence. In this case, as already demonstrated, asset prices one period hence will be higher and equal to p'_{t+1} in Figure 3 and 4. But present income and hence current saving are not changed. The present asset prices therefore continue to be determined by the schedule $J(w, b)$. At a future asset price p'_{t+1} the current equilibrium asset price is thus indicated by point E" in either of the diagrams.

There is an interesting difference between the two cases. If saving responds positively to the rate of interest (Figure 3) a future increase in income raises both future and present asset prices. In this case all generations, the old, the current young and future generations benefit. The old make capital gains, the young have the advantage of higher short-term interest

⁷The elasticity of saving with respect to the shortterm asset price q_t is given by: $\lambda \equiv \partial \ln s / \partial \ln q = \phi [\theta(c_2) - 1] / [\theta(c_1) + \theta(c_2)\phi]$ where $\phi \equiv c_1 / qc_2$. It is readily shown that with an elasticity of the marginal utility $\theta(c_i)$ larger than unity, the elasticity of saving with respect to the asset price must be less than unity. Hence an increase in asset prices creates an excess demand for bonds.

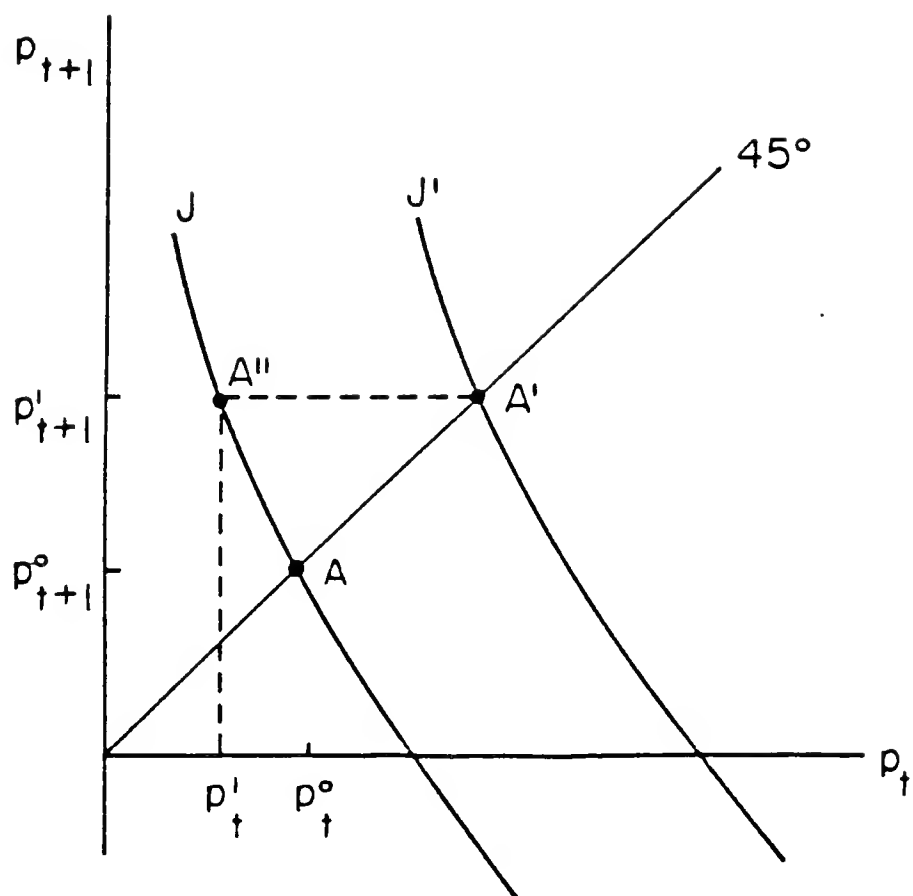


FIGURE 4

rates and future generations have the benefit of increased income. This is possible because high intertemporal substitutability allows the shifting of consumption of the young to the future when output is more plentiful. In fact, while the consol price rises in the present period and thus the longterm interest rate declines, the shortterm interest rate rises and this induces intertemporal substitution freeing resources for the old to share in the future income.⁸

The case where intertemporal substitutability is low, and thus saving responds negatively to higher interest rates, is shown in Figure 4. Higher future income leads to a current fall in consol prices at point A". With present consol prices falling the old lose as a consequence of higher future incomes, but the current young gain relatively more because the shortterm interest rate rises strongly. The explanation is as follows. At unchanged present consol prices higher prices next period represent prospective capital gains for the young. With income effects dominating substitution effects the young respond by reducing saving, preferring to consume presently part of these capital gains. As a consequence there is an excess supply of bonds and an excess demand for goods leading to increased shortterm rates. It is clear then that the attempt to smooth consumption, when it dominates substitution, accounts for large interest rate and asset price movements. This is, of course, the point noted by Grossman and Shiller (1981).

⁸The analysis is easily extended to the case where future income growth is transitory or occurs at a more distant point in time. In the latter case the consol price will rise gradually toward the longrun level if saving responds positively to the rate of interest. Otherwise asset prices show a backward dampened oscillation. See also Fischer (1979).

The response of short and longterm interest rates today to a future disturbance is further explored in (9). We define the shortterm interest rate as $1 + r_t = 1/q_t$ and the longterm rate as $R_t \equiv 1/p_t$. With these definitions, using the goods market equilibrium condition and the definition of q_t we can show the following;

$$\frac{dr_t - dR_t}{dp_{t+1}} = \left[(1-q) \frac{1}{1-\lambda} + 1 \right] p_{t+1}, \quad \frac{dr_t}{dp_{t+1}} = \left[1 + \frac{1}{1-\lambda} \right] p_{t+1}, \quad \hat{p}_t = - \frac{\lambda q_t}{1-\lambda} \hat{p}_{t+1} \quad (9)$$

where λ is the elasticity of saving with respect to the asset price q_t and is a quantity smaller than unity. (See footnote p.7.) From (9) an increase in future asset prices or a decline in the future longterm interest rate must raise the present shortterm rate and must raise it relative to the present long rate. Furthermore, the increase in the short relative to the long rate is larger if the saving response to the interest rate is negative and large.

Debts and Deficits.

A change in debt outstanding affects both the supply of debt and the value of disposable income. With a marginal propensity to save that is less than one increased debt creates an excess supply of bonds and, in terms of Figure 3 or 4, leads to a leftward shift of the J- schedule. Thus debt issue lowers steady state asset prices and raises steady state interest rates. Steady state welfare unambiguously declines.

The transition effects of the debt issue depend on the manner in which the debt is introduced. Assume that the government gives the bonds to the current old and that the bonds yield a coupon already in the transition period, financed by taxes on the young. Then the economy moves immediately to the new steady state. If on the contrary the bonds were given to the old without a current period coupon, or if they were given to the young there would be a transition period in which the welfare distribution depends on how the bonds are

introduced.

Consider now a simple case of deficit finance: the government transfers an amount T to the present old generation, raising the revenue by issuing consols in the amount $db = T/p$. Starting next period the service of the consols is assured by increased taxation so that except during the current period the budget is balanced. What is the effect of such deficit finance on interest rates? From the analysis of Figures 3 and 4 we have already seen that starting next period the steady state asset price must fall. In the longrun the increased supply of debt must generate some crowding out even though the debt service is fully financed by taxation. In the present period where there is a budget deficit the effect on short and longterm interest rates is uncertain.

A clear solution prevails if saving responds positively to the interest rate, the case on which we concentrate now. In that event both the current short and longterm interest rates must increase. As of a given asset price there is an increased supply of bonds outstanding while demand is reduced because of anticipated capital losses. Equilibrium asset prices must fall to reduce the value of bonds outstanding and to raise saving by reducing expected capital losses. Moreover it can be easily (though tediously) be shown that in this case the shortterm rate will rise above the longterm rate. Accordingly in this case during periods of deficit finance the term structure is negatively sloped.

The analysis is readily extended to anticipated future deficits followed by subsequent taxation to service the increased debt. Specifically suppose the public anticipates transfers to be made two periods hence with increased taxation to service the higher debt starting the following period, period four. From what has been said in the preceding paragraph we know that in period four and beyond asset prices will be permanently lower. Moreover, as shown above asset prices will already decline during the deficit finance in period three.

Immediately prior to the deficit financed transfers, in period two, there are two effects at work. The anticipation of declining asset prices reduces saving and that effect is reinforced by the transfers which the young now anticipate to receive while old. To restore goods market equilibrium both the short and longterm rate must therefore increase in period two. Finally in the current period the only effect at work is the anticipation of a decline in period two asset prices which reduces saving. Using (9) we note that asset prices will decline in the first period, too. The longterm rate thus rises immediately, but we also note from (9) that the shortterm rate will fall. We therefore have established that in anticipation of future deficits the term structure of interest is upward sloping. It is also apparent from the analysis that future deficits, via their effect on asset prices, represent a tax on the present old generation.

3. The Open Economy

We now assume two countries identical in respect to tastes and population, but with potentially different incomes and debt outstanding. We are interested in determining the equilibrium asset price in the world as well as patterns of lending. Throughout we look at the case of one good and one asset. A tilde denotes stocks outstanding so that \tilde{b}^* is the existing stock of foreign-issued consols and b the actual holdings by the home country's old.

Equilibrium in the world goods market requires the balance of world income ($\tilde{w} + \tilde{w}^*$) and world consumption by the two generations in each country:

$$\tilde{w} + \tilde{w}^* = c_1 + c_1^* + (\tilde{b} + \tilde{b}^*)(1+p) \quad (10)$$

An alternative way of writing the equation is:

$$s(q, w) - p\tilde{b} = p\tilde{b}^* - s^*(q, w^*) \quad (10a)$$

In this form we focus on the capital market. The excess of home saving over the

value of debt outstanding equals net foreign lending.

The determination of equilibrium asset prices in the open economy is the same as that already studied in Figure 1 for the closed economy. We can directly turn to some questions of comparative statics and welfare.

Opening Trade

The first question concerns the welfare effects of the opening of trade in securities. Suppose the two countries were initially in autarchy and that now international lending becomes possible. For concreteness we assume that the home country has the higher ratio of disposable income to debt, $w/\tilde{b} > w^*/\tilde{b}^*$. The autarchy asset price in the home country would therefore be higher than that abroad.

On opening of trade in securities asset prices at home would fall and abroad they would rise. At home the old would experience capital and welfare losses and abroad they would gain. The rise in interest rates at home would benefit the young and the fall in interest rates abroad would hurt the young generation there. Thus the opening of trade, through distribution effects, makes some groups worse off. This is a theme familiar from traditional trade theory, also demonstrated in the intertemporal trade literature referred to above.

Since the opening of trade benefits the young, but hurts the old, we can ask whether a simple transfer would make the opening of trade possible without deteriorating any group's welfare in general. Consider first a situation where taxes can only be levied on generation in the transition. To maintain welfare of the old their consumption level in the absence of trade, c_2 , would have to be maintained. They would accordingly have to be compensated for consol price changes in the amount $-\tilde{b}dp$. This transfer reduces disposable income of the young whose welfare changes by:

$$dU/V' = \tilde{b}dp - c_2dq = q\tilde{b}dp \quad (11)$$

which is unambiguously negative. The reason for the net welfare deterioration is that the young gain from the terms of trade improvement for only one period while the old suffer a capital loss on a consol.

An alternative is to compensate the old by a transfer from the young and from all future generations, who will come to benefit from the higher interest rate. To do this the government would issue consols the proceeds serving to compensate the old, and the service being assured by increased taxes on the present and future young. The increase in debt is equal to $db = -\frac{\tilde{b}}{1+p}dp$ and this is only a fraction of the capital losses incurred by the old.⁹

Using this expression now in (8) we have:

$$dU/V' = dw - c_2dq = bdp/(1+p) - qc_2(1-q)dp/p = 0. \quad (11a)$$

The calculation shows that opening to trade with compensation, at the margin, has no impact on welfare. The reason is the following: The gains from trade experienced by the young c_2dq are exactly equal to their share in the losses of the old with whom, in the initial equilibrium they trade. Hence full compensation for these terms of trade effects leaves welfare exactly unchanged.

But this does not mean that there are no gains from trade once price changes in the transition to the open economy equilibrium can be larger than infinitesimal. Figure 5 illustrates the possibility for the logarithmic utility case: $U = \ln c_1 + \ln c_2$. It is readily shown that the free trade price is given by:

$$p' = ap + (1-a)p^* \quad , \quad a \equiv b/(b+b^*) \quad (12)$$

⁹The government taxes the present and future young by an equal amount db . Taxes on the current young, db , plus the value of the bond transfer, pdb , must equal the capital losses. Hence we have $bdp = -(1+p)db$ or $db = -bdp/(1+p)$.

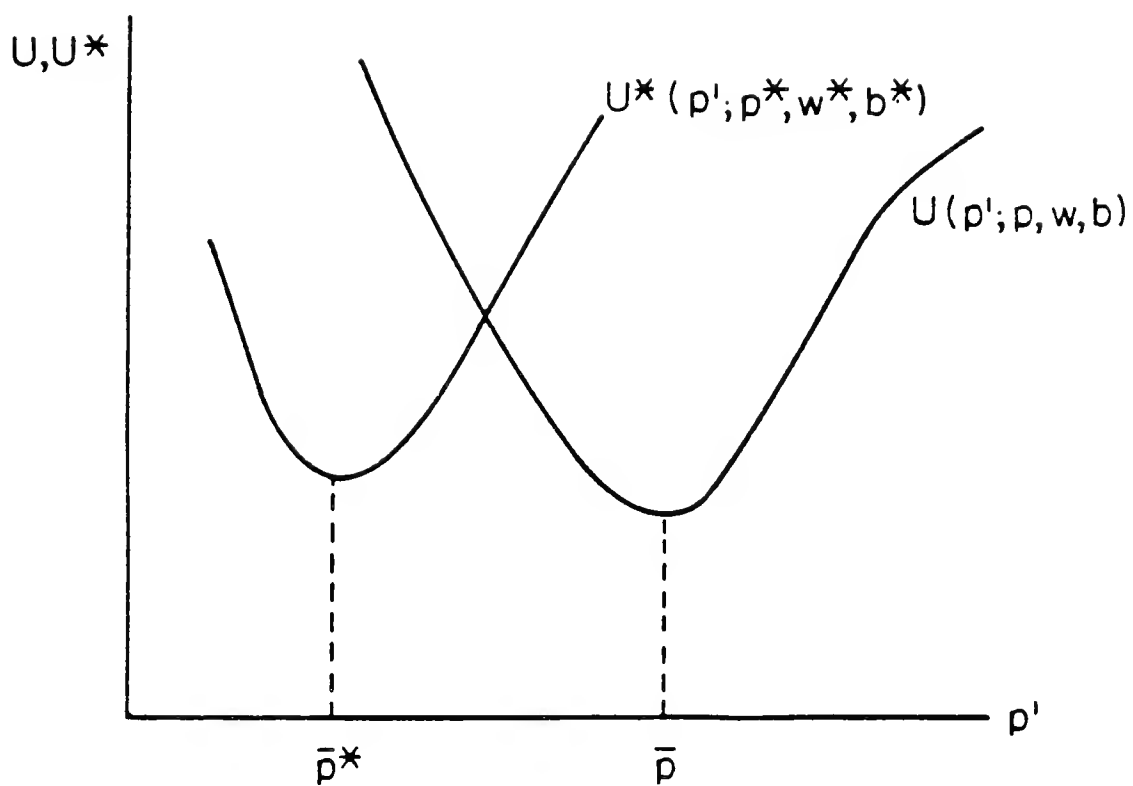


FIGURE 5

The free trade price thus is the weighted average of the autarchy prices p and p^* with weights given by the relative bond supplies. Consumption in the two periods is given by $c_1 = (w+k)/2$ and $c_2 = (w+k)/2q'$ where $k \equiv b(p'-p)/(1+p')$ is the compensation tax. Using these expressions the value of the utility function is:

$$U = -2\ln 2 + 2\ln(w+k) + \ln(1+1/p') \quad (13)$$

This function has a minimum at $p=p'$, a result we already saw in (11a). In Figure 5 we plot the home and foreign utility functions against the free trade price.

Since the free trade price settles in the range between the autarchy prices p and p^* there will in general be gains from trade for both countries.

We have now shown that when compensation takes the form of an equal tax on the current and each future generation there will be gains from trade. We can return to the question whether there can be a gain, for sufficiently large discrepancies between free trade and autarchy prices, even in the case where the full compensation is paid by the current young. Figure 6 shows an example for the logarithmic case. It can be shown that in this case the autarchy price lies in the range of the utility function where it is positively sloped. In the example shown the autarchy price can settle near p^* if the foreign relative bond supply is large.¹⁰ In that case it is possible that the home country is better off, present and future generations, even though the compensation is fully paid by the transition generation. We also note that in the high interest rate country welfare must improve independently of the magnitude of price change in the transition to free trade.

¹⁰Figure 6 is drawn on the assumption $p > p^*$ and $w = w^*$. Disposable income after the opening of trade is $w + (p'-p)b$. The value of utility as a function of p' therefore is $U = 2\ln 2 + 2\ln(w+k) + \ln(1+1/p')$ with $k = (p'-p)b$.

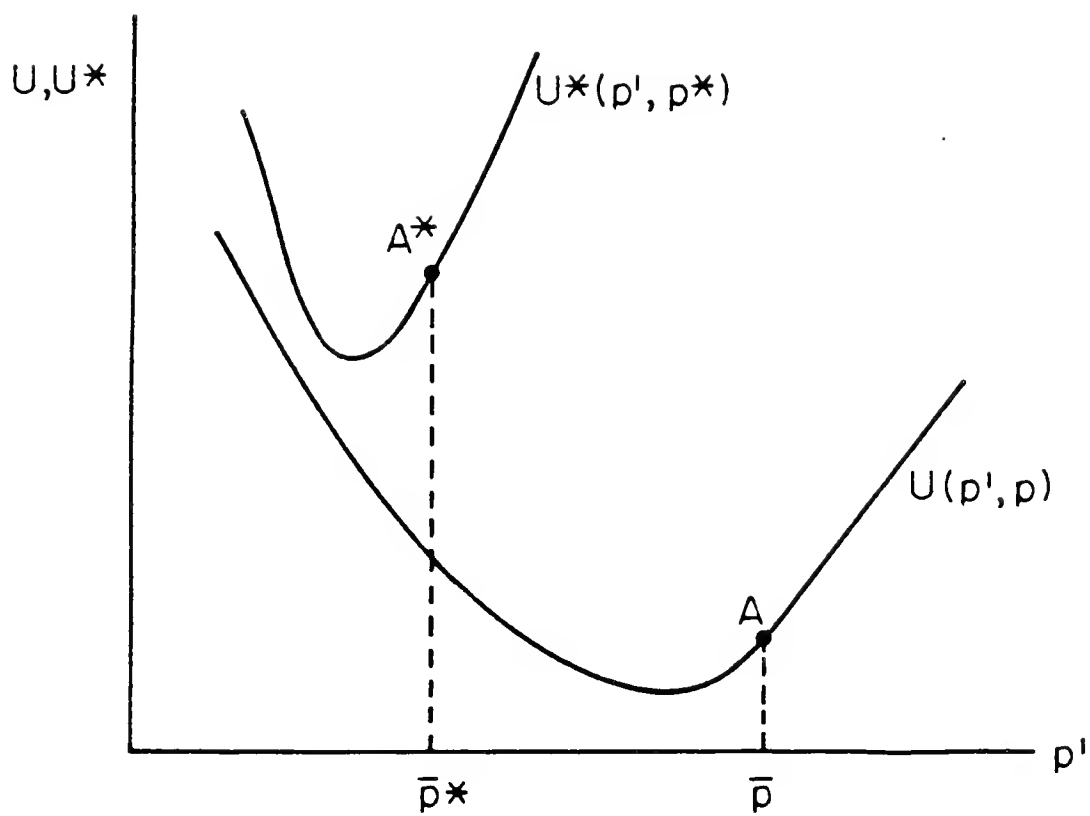


FIGURE 6

Some Comparative Statics

We now study the effects of permanent, current changes in income and in debt on equilibrium interest rates, the current account and welfare. We start with the case of a permanent rise in home income.

From the goods market equilibrium condition in (10a) we find that a rise in home income raises the equilibrium price of goods or lowers the interest rate just as it does in the closed economy:

$$\hat{p} = \frac{x}{1-\lambda(1-q)} \hat{w} \quad ; \quad x \equiv \frac{s}{s+s^*} \quad (14)$$

The extent of the decline in interest rates or rise in asset prices depends on the response of saving to the interest rate. Consider next the current account effects.

We define the net rate of capital outflow or the aggregate current account surplus of the home country as K:

$$K = s(q,w) - pb \quad (15)$$

The current account equals the excess of saving or lending by the young generation over bond sales--the excess of consumption over income from debt for the older generation--by the old. In the steady state the current account will be zero and the trade surplus will equal the net external debt service liability, $\tilde{b}-b$.

Using (14) and (15) yields:

$$\frac{dK}{dw} = \alpha(1-x) \quad , \quad \alpha \equiv qc_2/w \quad (16)$$

The current account effects thus depend only on the average propensity to consume in the second period and on the relative size of the home country. The larger the home country the smaller the current account effect of income growth. The higher the propensity to save the larger the current account effect.

The current account surplus of the home country is only transitory, leading to an increased home net lending position and, therefore, to a steady state deterioration in the home country's trade balance. Here is an interesting result in that higher income induces a steady state deterioration in the trade balance. The trade balance deterioration reflects the fact that the initial current account surplus has increased home debt holdings and with that has raised income relative to the endowment. Since in the new steady state aggregate disposable income is equal to expenditure, expenditure exceeds output and thus there is a trade deficit financed by income from net external assets.

Consider now the welfare effect of higher home income. The higher bond prices imply capital gains and increased welfare for the present old. Abroad steady state welfare declines since the fall in interest rates worsens the terms of trade of the young who are net lenders and whose welfare therefore deteriorates. At home the higher income raises welfare of the young, but this is dampened by the adverse rise in the relative price of future goods. The net effect, however, is a welfare improvement. Accordingly, the possibility of Edgeworth-like damnifying growth does not arise in this model.

The analysis of changes in debt is straightforward. From (10a) we calculate the effect of home debt issue on steady state asset prices as:

$$\hat{p} = - \frac{(\alpha + p)}{p(\tilde{b} + \tilde{b}^*)(1 - \lambda(1 - q))} d\tilde{b} \quad (17)$$

Thus, home debt issue must lead to a decline in asset prices or a rise in the equilibrium interest rate. Steady state welfare abroad must rise since lifetime utility as shown in (5) rises if asset prices decline, the young being net lenders. In the home country debt issue, just as in the closed economy, exerts offsetting effects through the reduction in disposable income due to higher taxes and the change in interest rates. Just as in the closed economy case, it can be

shown that the net effect is a reduction in lifetime utility both for the currently young and in the steady state.

The effect of home debt issue on the long run trade balance and external indebtedness can be definitely established: Home debt issue reduces net external assets, $b - \tilde{b}$, and therefore, leads to an improvement in the long run trade balance. This result is to be expected since abroad real income increases via the rise in interest rates thereby leading, through substitution and income effects, to higher second period consumption. With bond prices falling $c_2^* = (1+p)b^*$ implies that foreign bond holdings increase. The long run trade balance improvement for the home country thus reflects the counter-part of the differential foreign increase in real income and welfare.

We studied for the closed economy the case of currently anticipated, future income growth. In that case the equilibrium current shortterm interest rate rises immediately and falls once the increase in income occurs. Exactly the same result will, of course, arise in the world economy. The only question is whether future income disturbances have effects on today's current account.

It is readily verified that the present current account is unaffected by the future income growth. The reason is the complete symmetry of this one-good, one-asset model, with identical consumers who in the steady state have zero capital flows. To have an impact on the current account disturbances must affect the two countries' net saving differentially. This is the case of current disturbances but it does not arise for future disturbances, except when preferences differ.

4. Concluding Remarks

The intergenerational exchange model sets a minimal framework for addressing intertemporal issues in trade theory. The introduction of long term debt, and hence the term structure of interest, makes current accounts depend not only on

relative present incomes but also on future events. The model is a minimal framework and for that reason cannot go much further. But it is immediately obvious that extensions to a multiple commodity setting open up interesting questions as does the possibility of introducing real capital. Another range of questions is concerned with taxation of international lending and with an optimal external debt. These issues are left for further work.

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